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THE

CHARACEÆ OF AMERICA.

BY

TIMOTHY F. ALLEN. A. M., M. D.

WITH COLORED ILLUSTRATIONS FROM THE ORIGINAL DRAWINGS BY THE AUTHOR.

PART 2

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CHARA CORONATA, A. Br.

Var Schweinitzii

Armstrong & Co. Lith.

Plate III.

Drawn by T.F.Allen M.D.

Armstrong & Co. Lith.

Plate II

CHARA CRINITA. WALLR..

VAR. AMERICANA.

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CHARA GYMNOPUS. A. Br.

VAR. ELEGANS.

Plate I.

PLATE I.

CHARA GYMNOPUS, A. BR.

Var. elegans, A. Br.

Sub-order, CHARÆ. Verticills of leaves mostly surrounded by a whirl of stipules. Leaves many-celled, with bract-bearing nodes. Bracts one-celled, shorter than the leaf. Antheridium lateral occupying the place of a bract, on the inner (ventral) aspect of the leaf, usually single. Sporangium on ventral aspect of leaf. Coronula of sporangium consisting of a single series of five cells, persistent.

Genus, CHARA. Sporangium arising from the uppermost cell of the basilar node of an antheridium or a corresponding bract, hence axillary.

* DIPLOSTEPHANÆ. Whirl of stipules developed from a double series of cells, stem always corticated; leaves usually so.

* * PERFECTÆ. Cortex uniformly developed around the stem; the series of cells approximate leaving no interspaces.

* * * GYMNOPODES. First basal internode of the leaf naked, not corticated; other internodes triple-corticated.

* * * * MONŒCÆ. Antheridia and sporangia borne on the same leaf; in one species (*sejuncta*) on different nodes.

CHARA GYMNOPUS. This species has been established, by the late Prof. Braun, to include a large number of closely related forms from all parts of the world; and we are inclined to extend it so as to embrace all the monœcious Gymnopodæ.

The variation in size of plant, size and shape of sporangium, development of bracts, length of the naked basal internode (very short in some American varieties, var. *Humboldtii*, etc.; very long in *Ch. Angolensis* A.Br., and in *Ch. Robbinsii*. Halsted), number of corticated internodes, and of naked terminal internodes, development of the coronula, etc., is very great, and no satisfactory line can be drawn. Prof. Braun remarks in *Characeæ Africanæ* "So long as I knew but few forms of the *Gymnopodæ*, their distinction seemed easy; but when it became necessary to determine sixteen to eighteen forms, I concluded to consider them all varieties of a single species, for which *Gymnopus* seemed the most fitting, though *Ceylonica*, Klein and Willd., is the oldest name."

"Tenuiter incrustata, luteo-virens. Caulis aculeolis sparsis elongatis acuminatis oblique patentibus obsitus. Folia vert. 9–10. Corona stipularis sursum et deorsum evoluta, cellulis elongatis seriei superioris articulum foliorum infimum vix ad medium usque tegentibus. Articuli foliorum 8–9, infimo ecorticato hyalino sequentibus breviore diametro triplo- ad quadruplo-longiore, mediis 4–5 (rarius paucioribus) corticatis, superioribus 3–5 ecorticatis, ultimo brevissimo excepto, elongatis. Foliola omnium geniculorum evoluta, verticillata posteriora dimidio vel ultra breviora, anteriora sporangium paullo superantia. Sporangium oblongum, coronula brevi quinquedentata, nucleo (indumento calcareo dissoluto) atro 11–12-striato" *A. Braun*, *Ch. Africanæ.*

Var. ELEGANS, A.Br., in litt. Stems large with long spines, regularly disposed. Verticills numerous, approximate above. Leaves 9–12 in a verticill, with 7–9 articulations; basal internode naked, about twice as long as broad; upper internodes triple-corticated, except the terminal internode (rarely two or even three of the upper internodes naked). Stipules long and narrow, reaching nearly to the second articulation, the reflexed stipules nearly as long as the erect. Bracts developed at each articulation, verticillate, the dorsal scarcely shorter than the ventral, usually much longer than the sporangium and exceeding the length of the internode. Sporangium oblong, .60–.75 m.m. long, .40–.50 m.m. broad. Coronula large, spreading. Nucleus oval, black, about 12-striate on one side (impress of the enveloping tubes of the sporangium).

This beautiful species is not uncommon, new localities frequently coming to our notice: Peekskill, N. Y.; Lakeville, Conn.; Essex Co., Mass. (Oakes, Mr. John Robinson), etc.

A number of varieties of *Ch. gymnopus* occur in different parts of the country which might be confounded with var. *elegans*. The following may be mentioned in this place; later they will be described in detail and figured.

Var. Humboldtii, A.Br. (Plantæ Lindheimerianæ, Gray and Engelmann, p. 56), *C. compressa*, Kunth.; *C. foliolosa*, Willd. (Mühlenb., cat. pl. Amer., sept.: figured in Kützing, tab. phyc. VII, t. 77 (*not a good figure*, A.Br.), reported from Venezuela, Mexico, Texas (Wright and Lindheimer), and from Pennsylvania (Mühlenburg). A large species with shorter stipules and short bracts.

Var. Michauxii, A.Br. *l.c.* reported from Caraccas, 1855, Ohio (Michaux, 1797), Missouri (Engelmann); Texas (Lindheimer), Mexican boundary (Wright). The largest of all the forms with still shorter stipules and very small bracts.

Var. conjugens, A.Br. Characeæ of Central America 1858, Mexico, Texas (Lindheimer, Wright).

Var. trichacantha, A.Br. Mss., Texas (Wright); S. Carolina (Ravenel).

To these must be added a new and small variety from Prof. Bessey of Iowa, also, we think:

Ch. sejuncta, A.Br., Plantae Lind., which is only a Gymnopus with the antheridia and sporangia developed on different articulations of the same leaf reported from Brazil (Martins), Missouri (Engelmann), Massachusetts (Robinson in Halsted's Monograph, 1878). The whole plant is, to be sure, smaller, but the separation of the fructifying organs can scarcely be a persistent feature. This form is a transition to the distinctly diœcious gymnopod, *Ch. Martiana* of South America.

The length of the naked, basal internode varies not only in different varieties but at different ages of the same variety; in var. *Humboldtii* it is very short; in a new variety from Iowa is is so short that it is entirely hidden in the verticill; in

Ch. œrstediana, A.Br. (a gymnopus), it is as long as the other internodes. This latter variety also presents naked terminal internodes which we find not infrequent, in *var. elegans*; the same is true of *Ch. Angolensis*, A.Br. *Ch. Commersonii*, A.Br. (Kützing, Tab. Phyc. 78) has a shorter basal node but naked terminal internodes.

So the variations are very great and devoid of any morphological character like that which determines the *gymnopodæ*. Indeed, even in this we find evidence of transition: *Ch. fragilis* and its allies differ from *Ch. gymnopus* only in the cortication of the basal node of the leaf; but in *Ch. brachypus* A.Br., the triple series of cortex cells which cover the basal node are imperfectly developed, devoid of chlorophyll and almost colorless.

Explanation of Plate I.

A. Plant natural size.

B. Verticill magnified 20 diameters; 1, main stem with series of cortex cells, three series to one leaf (only a portion of the 12 leaves of the verticill shown) and long spines; 2, stipules in a double series, one erect the other deflexed upon the stem; 3, the naked basal node of the leaf.

C. A leaf magnified 20 diameters with a naked basal internode, 8 corticated internodes and a terminal naked internode; 1, one of the two stipules; 2, bracts longer than sporangium or node, developed all around the leaf; 3, cortex cells, in a triple series, divided as usual in the middle of the internode, the upper half developed downward from the node above, the lower half developed upward from the node below; 4, the sporangium with black, oval nucleus and spreading coronula of five, pointed cells (In this well fruited specimen, a sporangium but no antheridium, was developed on the first node); 5, the antheridium occupying the place of a bract and bearing the sporangium in its axil.

PLATE II.

CHARA CRINITA, WALLR.

Var. Americana.

Euchara, Diplostephanæ, Perfectæ.

Division, HAPLOSTICHÆ. Series of cortex cells equal to the number of leaves,

CHARA CRINITA, Wallr. Ann. bot. 115. *Ch. canescens*, Lois.; *Ch. horridula*, Detharding: *Ch. condensata*, Wallm.; *Ch. hispida* var. *crinita*, Wahl. Dicœcious; antheridia rarely found. STEMS rigid, clustered, erect, mostly simple, densely beset with fascicled hairs, which are in length twice the diameter of the stem. Cortex consisting of large cells parallel to the axial cells, separated by deep longitudinal furrows, not spiral. (See D, a longitudinal section of stem, made by embedding the stems in pith, in a "section-cutter"). VERTICILLS distant, 8—10 radiate (branched). STIPULES in a double series, twice the number of branches; each primary stipule-cell supporting a double stipule developed upward and downward. (See figs. B and D.) BRANCHES erect and spreading, rigid, corticated as far as the apical cell, articulations 4—7, each joint bearing 5—8 bracts. SPORANGIA varying in form and size, "forma pachysperma" short and broad, "forma leptosperma" long and narrow; nucleus black; coronula truncate not spreading. LEAFLETS whorled 5—8, longer than the sporangium, except 2–3 very short ones occupying the place of bracts.

VAR. AMERICANA. Robust dark-green. Length of sporangium and coronula, 0.70 m.m., of nucleus, 0.56; breadth of sporang., 0.56; of nucleus, 0.50; of coronula, 0.18. This variety is, in general appearance, related to *var. Baltica*, A.Br., but that form is only half the size, and belongs to the series designated by "forma leptosperma," while our var. belongs to "forma pachysperma." Our form also differs widely in growth and habit from *Ch. condensata*, Wallm. ("forma pachysperma humilis condensata," A.Br., No. 80, Braum, Rabenh., Stizent., charac. exsic.), described by Wallman as "pumila, obesa, obscure viridis; verticillis confertis, densis, subglomeratis."

Gathered in brackish (nearly salt) water, in Great Pond, Montauk Point, Long Island; associated with *Ch. aspera*. Prof. Braun remarked this association of the two species in America as interesting, since they are always found together in the Old World.

April, 1879.

Since writing the above we have received from Mrs. Maria L. Owen *forma leptosperma*, collected in Nantucket, Mass.; thes. specimens agree with the European ones.

N. TENUISSIMA, A.Br. (Desv.)

Var. Americana.

A. Braun in Plantæ Lindheimerianæ, Boston, 1845.

"Whorls less densely glomerate but more approximate than in the European form." We have received from Mr. A. H. Curtiss, Jacksonville, Florida, some specimens which are larger and more open and which may be referred to this variety. Prof. Braun received examples from Texas (Lindheimer), and from Massachusetts.

Another form from N. Jersey, with very dense and approximate whorls, very short leaved, terminal leaflets mostly six, fruit very large, intermediate in size between *tenuissima* and *batrachasperma*, will probably constitute a new species.

Explanation of Plate II.

A, natural size of plant. B, main stem magnified. C, fertile branch magnified. D, longitudinal section of main stem.

PLATE III.

CHARA CORONATA, ZIZ. INED. 1814; A.BR., FLORA, 1835.

Var. Schweinitzii, A.BR., FLORA, 1835.

Ch. foliolosa, Schweinitz (*Ch. foliolosa*, Willd., in Act. Acad. Berol. 1803, p. 58, and in Muhlenb. cat. pl. Amer. sept. 1813, p. 18, is probably *Ch. gymnopus* var. *Humboldtii* A. Br.). *Ch. opaca* Schweinitz *non* Agardh.

Illustration: Kutzing, Tab. Phycol. VII. Tab. 79, 1.

EUCHARA; HAPLOSTEPHANA. Circle of stipules consisting of a single series of cells. (Developed into stipules. Rudimentary cells are found in species belonging to this section: see Plate, Fig. B.)

UNISTIPULATA: A single stipulary cell at the base of each leaf.

ECORTICATA: Cells of cortex not developed; internodes naked.

MONŒCA: Sporangia and antheridia borne on the same plant.

CHARA CORONATA, as defined by A. Braun in his Characeæ of Africa. 1868. "*Folia* verticilli 9–11, articulis 4–6, elongatis 3–5, ultimo brevissimo mucroniformi. *Foliola* in omnibus geniculis præsentia, geniculi supremi cum mucrone terminali coronulam 3–ad 5–cuspidatam formantia. *Foliola* posteriora breviora, depauperata aut omnino deficientia, anteriora sporangium subæquantia, rarius sporangio longiora, sæpius breviora. *Stipulæ* foliolorum fere magnitudine. *Antheridia* et sporangia in eadem geniculo haud raro geminata vel ternata. Sporangii nucleus ater, indumento calcareo carens, striis a latere conspicuis 7–12," includes, in addition to the synonymes given above, *Ch. Braunii* Gmel., Fl. Bad., 1826; *Ch. flexilis* Amici, 1827; *Ch. cortiana* Bertoloni, 1854; *Ch. involucrata*, Rogh., 1832; *Ch. Oahuensis* Meyen, 1835; *Ch. cremosperma* Rupr., 1846; *Ch. Stalii* Visiani, 1852: and comprises the following varieties.

var. BRAUNII, *microsperma*. Nucleus 0.42–0.55 m.m. in diameter; bracts mostly shorter than sporang.; no bracts on dorsal aspect of leaf. (The common European form.)

var. PERROTTETII, *macrosperma*. Nucleus 0.60–0.65 m.m. in diameter, bracts equalling the sporangium. (African.)

var. SCHWEINITZII, *mediasperma*. Nucleus 0.52–0.60 m.m. in diameter (T. F. A.). *Bracts* exceeding Sporang., developed often on the posterior aspect of the leaf; exhibiting two extreme forms: *forma macroptila* (longibracteata), the *Ch. foliolosa* of Schweinitz; *forma microptila* (brevibracteata), the *Ch. opaca* Schw. *non* Agardh.

var. MEYENII (*Ch. Oahuensis* Meyen). Delicate habit, characterized by the elongated cells of the coronula. (Sandwich Islands.)

the polymorphous variety found in America may be described as follows:

Euchara, Haplostephana, Unistipulata, Ecorticata, Monœca; Plants variable in size from six to eighteen inches in length; stems tufted from a single root, much branched, bright green or sometimes olivaceous; stems not corticated, perfectly smooth, glistening when dry; *without incrustation*;* *Whorls* of leaves numerous, subtended by whorls of stipules; leaves in a whorl 8–11; *stipules as many as the leaves and alternate with them,* in young whorls as long as or longer than the first node of the leaf, in old whorls becoming much shorter (as the internode elongates). *Leaves* numerous, 8–11 in a whorl, elongated, longer than the internode of the stem (except in fully developed plants or internodes), the upper ones long, overlapping the nodes and forming a dense spike which opens out after fruiting; (A, fig. 2); *articulations* of the leaf 4 to 6, the ultimate one very short, and with the bracts forming a 3–5 pointed crown or tuft. (The tips of the leaves vary greatly even in the same plant; see B, 4, 5 and 6.) *Bracts* developed on all the nodes, much longer on the anterior (ventral) than on the posterior (dorsal) aspect, rarely fully developed posteriorly (see C, 1.) often entirely undeveloped on the dorsum of the upper nodes (see B, fig. 2). USUALLY MUCH LONGER THAN THE SPORANGIUM. This chief distinguishing feature of the American variety is exceedingly variable; not only does the comparative length of the sporangium and its bracts vary in different localities, but even in the same plant; small specimens approach closely the European variety (Braunii); a Canadian form has bracts more than twice the length of the mature sporangium: Prof. Braun in Flora, 1835, remarks that "the American variety is very variable; one form with *long lateral* bracts is *Ch. foliolosa* of Schw., another with elongated leaves but with *short lateral* bracts is *Ch. opaca* Schw." *Antheridia and sporangia,* usually single, sometimes double or even triple, developed on the first and second nodes of the leaf. *Antheridia* large bright orange; *sporangia* broad-oval, crown with *connivent tips* (not spreading as in the typical form). (When young (B. fig. 2.), the cells stand apart, as in nearly every species, and the body is long and narrow, as usual). *Nucleus nearly round, black,* 0.52–0.60 *m.m. in diameter.* Furrows on one side of the sporang. 11–12, on nucleus 9–10, not prominent when mature. Enveloping tubes of sporangium reddish-orange when mature, green when young. This variety is quite common throughout America, growing in shallow ponds or brooks, loving a sandy bed: it may be distinguished from the typical form by its smaller size, *the closely connivent cells of the crown of the sporangium, and the long bracts;* in *Ch. coronata* the cells of the crown are erect or somewhat spreading, and the bracts rarely exceed the sporangium in length. A Canadian form exhibits divergent or erect cells of crown; *bracts very long,* often more than twice the length of the sporangium, *and a definite incrustation.* We may expect to find every variety of size, length of bract, size of nucleus (which latter mark Prof. Braun relied much upon,) and variety of coronula in our American forms of this species (as in *Ch. gymnopus fœtida,* etc.).

Explanation of Plate III.

A. Plant natural size; fig. II more developed stem, after fruiting.

B. Leaf magnified 20 diam., showing under surface of an older whorl, stipules alternate with leaves, with rudimentary cells of second row and of cortex. Fig. 1, mature antherid. and sporang.; fig. 2, a second node with quite young sporang., no bracts on dorsum; figs. 4–6 apices of leaves.

C. Leaf with external view of whorl; fig. 1, bracts developed on dorsum as on front of leaf, *forma foliolosa.*

* A very interesting form from Prof. Macoun, Canada, is incrusted; other peculiarities may, however, entitle it to rank as a distinct variety.

THE

CHARACEÆ OF AMERICA.

BY

TIMOTHY F. ALLEN, A.M., M.D.

WITH COLORED ILLUSTRATIONS FROM THE ORIGINAL DRAWINGS BY THE AUTHOR.

PART I.

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Drawn by T.F.Allen. M.D.

Armstrong & Co. Lith.

, Plate VI.

NITELLA TENUISSIMA, Desv.

Drawn by T.F.Allen M.D.

Armstrong & Co. Lith.

NITELLA FLEXILIS.
VAR. NIDIFICA WALLM.

NITELLA FLEXILIS. AG.
VAR. CRASSA A.BR.

Plate V.

Drawn by T.F.Allen M.D.

Armstrong & Co. Lith.

Plate IV.

NITELLA FLEXILIS, Ag.

PLATE IV.

NITELLA FLEXILIS, Ag.

N. Brongniartiana Coss. et Germ., Atlas, 1845, t. 40; *Chara flexilis* Ag. in part Schkur, 1808; *Chara inermis pellucida* Schmiedel Ic. pl., t. 14; *Ch. furculata* Rchb. in Mœssl. Handb.; *Ch. Brongniartiana* Coss. Germ. et Weddell, Catal. I pl, 1842; *Ch. commutata* Rupr.

Sub-family NITELLÆ. *Stem* and *leaves* never corticated; the latter in whorls of 5–8 (often increased by small accessory ones) with one or at most 2–3 nodes, bearing leaflets, *Leaflets* greatly developed consisting of one to many segments, often having a secondary leaflet-bearing node which may be several times repeated. *Sporangia* arising directly from the nodes of the leaves (this is still unsettled as regards Tolypella), often clustered, with a short stipe and a proper basilar node. *Coronula* ten-celled, formed by the two celled extremities of the five enveloping-cells, small, colorless, either persistent or evanescent without an inner calcareous layer.

Genus NITELLA. Leaves two-to several-segmented, but with only one node bearing leaflet. *Leaflets* either similar to the leaves and not again divided or again provided with a node, bearing secondary leaflets and over-topping the primary ray (stem or branch), when they are either simple, or repeatedly forked with numerous tips (flabellatæ); these ultimate divisions one-to-many-segmented. *Antheridia* APICAL on the primary ray and secondary divisions of the leaves, separated from the leaflet bearing node by a low, disk-shaped stipe-cell, hence appearing in a fork. *Sporangia* LATERAL, ON THE NODES OF THE LEAF, single or numerous, in monœcious species appearing just beneath the antheridium (A. Braun).

This genus has been divided by Prof. Braun as follows:

I. MONARTHRODACTYLE, ultimate segments of the leaves one-celled (coronula evanescent).
II. DIARTHRODACTYLE, ultimate segments two-celled (coronula persistent).
III. POLYARTHRODACTYLE, ultimate segments 3–6 celled. Each of these subdivided as follows:

- I.
  - FURCATÆ. (Simply divided.)
    - HOMŒOPHYLLÆ. (Leaves of a verticill of equal length.)
      - DIŒCÆ.
        - GLEOCARPÆ. (Anth. and spor. enveloped in mucus.)
        - GYMNOCARPÆ. (No mucus.)
      - MONŒCÆ.
        - GLOCOCARPÆ.
        - GYMNOCARPÆ.
    - HETEROPHYLLÆ. (Leaves of a verticill variable; some small, some long.)
      - Only one monœcious species *N. Clavata* (N. America.,
  - FLABELLATÆ. (Repeatedly divided.)
    - all HOMŒOPHYLLÆ.
      - DIŒCÆ.
      - MONŒCÆ.

Nitella flexilis Ag., Monarthrodactyle, Furcatæ, Homœophyllæ, Monœcæ, Gymnocarpæ. Stem rather large, usually elongated (often two to three feet long), branched. Leaves mostly 6– rarely 7 to 8– verticillate (when more than 6 the extra ones are smaller), leaves 2–3 divided, rarely undivided, leaflets *abruptly and minutely pointed. Antheridium* apical, on the extremity of a leaf, subtended by two or three leaflets, *or by sporangiain place of the leaflets. Sporangia* broad-oval or sub-globose when mature, with an evanescent coronula of ten hyaline cells, 1 to 3 in number, occupying the place of leaflets beneath the antheridium.

Nucleus (ripe spore) oval, dark brown or black, *with* 7–8 *strong and sharp angles on one side* (a very important diagnostic mark), 0.40 -- 0.50 mm. long.

This Nitella is quite common in flowing streams, or still water. It appears early in the season and often attains a large size (over three feet long). Though branching freely it has a loose habit, the branches and leaves mostly divergent. Color usually dark green, rarely pale. The fruit may be found from early in June (about New York) till late in July. Two marked forms are found, one with elongated stems and long leaves (*forma elongata*) represented in the plate; another not half the length or even a few inches long but of a spreading habit (*forma brachyphylla*). The chief varieties (*nidifica* and *crassa*) are delineated in plate V.

The most common form of fruiting is represented in fig. 3, one leaflet, and one sporangium occupying the place of the other leaflet; next in frequency we find fig. 5, a fruiting leaf that normally carries 3 leaflets with no sporangium as in fig. 4: when two sporangia develop on the node of such a leaf the third leaflet is considerably shortened (fig. 6). Antheridia are commonly found in the forkings of sterile leaves or even within a verticill when they apparently occupy the place of a branch. It will be noticed that the exact reverse to the fruiting of Chara pertains in Nitella; in the former the antheridium occupies the place of a bract (leaflet) and the sporangium is above it (or above the bract in diœcious species); the sporangium representing a transformed shoot or branch. In Nitella, the sporangium *is not axillary to a leaflet*, and in scores of examples of *N. flexilis* we have never found two leaflets and also two sporangia at the same node, as represented in *Sach's Lehrbuch der Botanik.*

Two other species are found in America, belonging to the same section of Monarthrodactyle furcatæ homœophyllæ monœcæ. *N. acuminata* A.Br. (possibly a sub-species of *N. flexilis*) characterized by the long-acuminate tips of the leaflets, contracted leaves and very small fruit. Dr. Engelmann has reported a var. *subglomerata* from Ill. (Mead) and *forma brachyteles* from St. Louis.

The other species belongs to the glœocarpæ (fruit enveloped in mucus) *N. prælonga* A.Br., a gigantic species, gathered by Dr. Ravenel in the Santee canal in 1851, sent by Dr. Engelmann to Prof. Braun and named by Prof. Braun; subsequently found in Texas (Lindheimer) No. 753. (*N. gelatinosa* A.Br., to which this has been referred as a variety, belongs to the third general subdivision of the genus, *Polyarthrodactyle.*)

Explanation of Plate IV.

Fig. 1, plant natural size (*forma elongata*); 2, leaf terminating in two leaflets with an antheridium in the axil; 3, a similar leaf with one leaflet and one sporangium; 4, a leaf terminating in three leaflets with an antheridium in the axil; 5, a similar leaf with two leaflets and one sporangium; 6, two sporangia and one leaflet; 7, a ripe nucleus (spore) with 8 sharp angles and furrows, caused by the enveloping cells of the sporangium.

The leaflets have been somewhat shortened for lack of room; note also that though both antheridia and sporangia are represented of mature size, in reality the antheridia mature before the sporangia of the same node.

PLATE V. A.

NITELLA FLEXILIS, AG.

Var. nidifica Wallm. (1853).

N. flexilis, var. *subcapitata* A. Br. (Br. Rahen. u. Stizenb. Char. exsic. No. 23. *Ch. nidifica* Hurtm., Sk. Fl. ed. 5. (*N. glomerulifera* A. Br., in Silliman's Journ. 1843, reported from New Hampshire, seems rather a variety of *N. acuminata* A. Br.)

This variety differs from the normal form in the suddenly abbreviated and crowded verticills of the upper leaves; due apparently to a great expenditure of energy in producing fruit. Frequently we find all the leaflets converted into sporangia and the leaf or stem correspondingly shortened. The general habit of the plant is, however that of *forma brachyphylla*, for even the sterile leaves are short, though in many of our specimens the internodes are quite long

The variety seems constant for it recurs year after year in the same locality growing (in Litchfield, Ct.) along with the normal and long-leaved form.

In the tendency of this species to form dense heads of fruit at the expense of the growth of stem and leaf, we find a great similarity to *N. capitata* and to capitate forms of *N. opaca*. Indeed, were it not for the dicœcious character of the latter species, it would be difficult to distinguish it from *flexilis*. The mature spore of *N. opaca* has not the prominent angles of that of *N. flexilis;* both species are very variable as to size, and sterile plants *cannot be determined with any certainty.*

This variety offers good advantages for the study of the fertilization of the ovule by the spermatozoid. In the Nitellæ generally, the spermatozoid enters the sporangium through fissures which open between the cells at its neck; the cells at the neck become small and do not retain the thickness of the lower portion of the investing cells of which they are a continuation; as the space under the coronula enlarges, openings form between these cells, at the neck of the sporangium, and the spermatozoid, on the rupture of the *antheridium* (which takes place when the sporangium is yet quite young) passes through these fissures into the space beneath the coronula and thence downward to the ovule. In this species and in a few others, nearly related, these fissures do not form, but the spermatozoid enters at the top between the cells of the coronula, an opening being formed by the rising up and separation of the cells, caused by the enlargement of the space under the coronula. (A. Braun).

PLATE V. B.

NITELLA FLEXILIS, AG.

Var. Crassa A. Br. Characeæ Europ. exsic. 101.

This variety may be distinguished by the large size of the stem as compared with its length. The plants are short and stout, generally quite dark green: the leaves are not long and *the leaflets of the fork are short and thick*, nearly always two, very rarely three. Fruit is not as commonly found as in other varieties.

We have received no specimens south of New York, but many north; from Prof. Macoun of Canada, Prof. Bessey of Iowa, Mr. Frost of Vermont, etc.

Prof. Nordstedt distributes specimens from Sweden, with sporangium and antheridium in nearly every fork. The European specimens, like ours, have very short leaflets, beyond the fork of the leaf; and in Europe as in America it is found in more northern regions.

Explanation of plate V.

A. *N. flexilis* Ag. var. *nidifica* Wallm. 1, plant natural size. 2, a verticill magnified 20 diameters. 3, a young branch early transformed into fruit, the young sporangia just ready for fertilization.

B. var. *crassa* A. Br., natural size.

PLATE VI.

NITELLA TENUISSIMA, DESV.

Chara flexilis tenuissima Bauer, C. glomerata Gmel.

Synonyms, *Diarthrodactyla*, *Homœophylla*, *Monœca*, *Gymnocarpa*. (See under *N. flexilis*.) *Stems* very slender, a few inches long (2--6 inches), sparingly branched, wall thin. *Verticills* remote, dense; consisting of 6 leaves (rarely 7). *Leaves* three to four times divided, the first segment longest, averaging 2 mm. in length, the other segments subequal, averaging 1.25 mm. in length; *the first node* of the leaf is always sterile, consisting of 6 rays, and a prolongation of the axis; *the second node* is usually fertile, bearing an antheridium within the verticill on the apex of the ray and one sporangium in place of one of the rays; this node is sometimes, though rarely, sterile (fig. 6 B), in which case the central axis is continued (in place of an antheridium, and there are normally 6 rays (instead of five and a sporangium); *the third node* is usually sterile (sometimes fertile); when sterile consisting of three rays, when fertile of two rays and a sporangium with an apical antheridium; these rays or leaflets of the third node are sometimes terminal, that is, they do not again divide (as in *N. Batrachosperma*, in which this node terminates usually in six leaflets). There are one terminal leaflet and two node-bearing leaflets (fig. 7 B); when this is the case the terminal leaflet is nearly as long as the node-bearing leaflets; *the fourth node* is always sterile consisting of 3--4 terminal leaflets; *the terminal leaflets* are somewhat rigid like the divisions of the leaves and of about the same length as the segments of the leaf above the first node; they are terminated by an apical, pointed cell about 0.125 mm. in length.

Sporangium single, usually borne on the second node of the leaf (those examined by us were 0.20 to 0.25 mm. in length, including coronula and stipe cell), broadly oval, surmounted by a minute and persistent coronula of ten cells; *nucleus* nearly round, chestnut colored, striæ 7–8 *not prominent*.

Variations. The plant varies with longer and shorter leaves, *formæ longifolia* and *brevifolia*; to the former our figure belongs. Some of the short leaved forms are very much contracted, a close dense mass surrounding the stem with elongated stems and distant verticills.

In the verticill of the stem are sometimes found long terminal leaflets, not bearing nodes, generally a single leaflet in a verticill arising between two leaves, reaching to the second node of the leaf and terminating in a mucronate cell: these adventitious leaflets are quite rarely found. The first, sterile, node of the leaf rarely has 7 rays in addition to the central axial ray

The second, fertile, node has but one antheridium and one sporangium; in addition to the sporangium there are five rays, rarely four (we have never seen more than five); this node may be wholly sterile (as at fig. 6 B), when the central ray is a trifle longer than the 6 verticillate rays, and all seven divide alike.

The third node is usually sterile, though occasionally we may find an intra-verticillate antheridium and rarely a nodal sporangium ; in the latter instance we have found two terminal leaflets, or one leaflet bearing another node and one terminal leaflet. The figure in Kutzing's Tab. Phyc. VII, 34, is unlike anything we have ever seen, viz., a simple fork with *two* terminal leaflets, or with one terminal and one forking leaflet, or with a terminal leaflet *consisting of three cells.*

Habitat. We have specimens gathered by Mr. Le Roy at Peekskill, N. Y., by Rev Mr. Wolle from northern N. Jersey (from these our figures were drawn, and we have gathered it in Long Island, and in Apponaug, R. I. ; it is also reported from Rhode Island (Dr. Robbins) and from Michigan (Dr. Cooley).

In N. Jersey it grows with *Chara sejuncta* and *Chara Hydropitys*. Doubtless it will be gathered in various parts of the country in quiet, shallow waters. It may be gathered in this latitude from July to September.

Explanation of plate.

A. Plants natural size.

B. A portion of the stem showing at "1," a verticill of six leaves and a young shoot magnified 40 diameters (only one leaf of the whorl is continued, to avoid crowding); "2," the first, sterile, node of the leaf ; "3," the second, fertile, node, occasionally sterile as at "6" ; 4, the third node bearing three rays, or at "7" two rays and one terminal leaflet; "5," terminal leaflet with a special apical cell (*Diarthrodactyla*).

Note. A notice of the long-leaved variety may be found in Part I of this work.